

What is claimed is:

1. A plasticating apparatus comprising:

a barrel having an inlet and an outlet;

a rotatable screw disposed within and cooperating with

5 an inner wall of said barrel, said screw adapted for

plasticating resinous material fed into said barrel through

said inlet, said screw comprising:

a longitudinal axis with a feed section, a barrier

melting section and a metering section disposed sequentially

downstream along said screw axis, a reorientation section is

disposed between the barrier melting section and the metering

section;

10 said screw including a main helical flight having a push

side and a trailing side, said main flight forming a feed

15 channel at said inlet of said screw;

a barrier flight disposed in said barrier melting

section intermediate said main flight, said main flight

having a constant pitch in the barrier melting section, said

barrier flight and said main flight dividing said barrier

20 melting section into a melt channel and a solids channel

extending helically side by side, said barrier flight having

helical threads with a diameter less than the diameter of

helical threads of said main flight, so that melt material flows over said barrier flight and into said melt channel, whereby solid material conveyed along said barrier melting section is positioned adjacent said trailing side and whereas 5 melt material conveyed along said barrier melting section is positioned adjacent said push side;

 said barrier flight discontinuing at a terminal end of said barrier melting section;

 said main helical flight passing into the reorientation section makes a rotation of at least 540° about said screw axis at a pitch less than the pitch of the main flight in the barrier melting section, said melt channel and said solids channel in said barrier melting section merging into a substantially uniform reorientation channel in said reorientation section thereby forcing solid plastic material 15 conveyed along said reorientation section toward said push side of the main flight; and

 a secondary flight disposed in said metering section intermediate said main flight, and said main flight continuing into said metering section from the reorientation section, whereby solid material conveyed along said metering section is positioned primarily adjacent said push side of 20

the main flight and whereas melt material conveyed along said metering section is positioned primarily adjacent said trailing side of the main flight.

5 2. The apparatus of claim 1, wherein said main flight has a substantially constant diameter throughout said metering section and said barrier flight has a substantially constant diameter throughout said barrier melting section.

10 3. The apparatus of claim 1, wherein said main flight has a thread width greater than said secondary flight in said metering section.

15 4. The apparatus of claim 1, wherein said barrier flight has a diameter substantially the same as said secondary flight.

20 5. The apparatus of claim 4, wherein said barrier flight has a width substantially the same as said secondary flight.

6. The apparatus of claim 5, wherein said metering

section is a multi-channel undulating metering section.

7. A plasticating apparatus comprising:

a barrel having an inlet and an outlet;

5 a rotatable screw having a longitudinal axis, the screw being disposed within and cooperating with an inner wall of said barrel, said screw adapted for plasticating resinous material fed into said barrel through said inlet, said screw comprising;

10 a feed section, a barrier melting section, a reorientation section and a multi-channel undulating metering section located sequentially downstream along said screw axis;

15 said screw including a main helical flight having a push side and a trailing side, said main flight forming a feed channel at said inlet of said screw at the feed section;

20 a barrier flight disposed in said barrier melting section intermediate said main flight, said barrier flight and said main flight dividing said barrier melting section into a melt channel and a solids channel extending helically side by side, said barrier flight having helical threads with a diameter less than the diameter of helical threads of said

main flight so that melt material flows over said barrier
flight and into said melt channel, whereby solid material
conveyed along said barrier melting section is positioned
adjacent said trailing side of said main flight and whereas
5 melt material conveyed along said barrier melting section is
positioned adjacent said push side of said main flight;

 said barrier flight terminating at a terminal end of
 said barrier melting section;

 said main helical flight traversing through the
10 reorientation section having a rotation at least 360° about
 the longitudinal axis of said screw, said main flight
 including a decreased pitch beginning substantially adjacent
 to the terminal end of said barrier melting section and
 resuming said decreased pitch through said reorientation
 section, said solids channel and said melt channel merge into
 a substantially uniform reorientation channel at a location
 substantially coinciding with said decreased pitch of said
 main flight thereby forcing solid plastic material conveyed
 along said reorientation section toward said push side of the
15 main flight; and

 said main flight passing into said metering section, a
 secondary flight being disposed in said metering section

intermediate said main flight whereby solid material conveyed along said metering section is positioned primarily adjacent said push side of the main flight and whereas melt material conveyed along said metering section is positioned primarily adjacent said trailing side of the main flight.

8. The apparatus of claim 7, wherein said solids channel and said melt channel maintain substantially constant widths through said barrier melting section, said solids channel narrows at a position along said screw coinciding with said decreased pitch of the main flight.

9. The apparatus of claim 7, wherein the main helical flight passing into the reorientation section makes a rotation of at least 720° about said screw axis.

10. The apparatus of claim 7, wherein the main helical flight passing into the reorientation section makes a rotation at least 1440° about said screw axis.

11. The apparatus of claim 7, wherein the main helical flight of the reorientation section having a helix angle θ of

approximately 19.5°.

12. The apparatus of claim 11, wherein the helix angle
θ of the main helical flight of the reorientation section and
5 the melting section are substantially equal.

13. A plasticating apparatus comprising:
10 a barrel having an inlet and an outlet;
a rotatable screw having a longitudinal axis, the screw
being disposed within and cooperating with an inner wall of
said barrel, said screw adapted for plasticating resinous
material fed into said barrel through said inlet, said screw
comprising;
15 a feed section, a barrier melting section, a
reorientation section and a multi-channel undulating metering
section located sequentially downstream along said screw
axis;
said screw including a main helical flight having a push
side and a trailing side, said main flight forming a feed
20 channel at said inlet of said screw at the feed section;
a barrier flight disposed in said barrier melting
section intermediate said main flight, said barrier flight

and said main flight dividing said barrier melting section
into a melt channel and a solids channel extending helically
side by side, said barrier flight having helical threads with
a diameter less than the diameter of helical threads of said
main flight so that melt material flows over said barrier
flight and into said melt channel, whereby solid material
conveyed along said barrier melting section is positioned
adjacent said trailing side of said main flight and whereas
melt material conveyed along said barrier melting section is
positioned adjacent said push side of said main flight;

said barrier flight terminating at a terminal end of
said barrier melting section;

said main helical flight traversing through the
reorientation section having a rotation at least 540° about
the longitudinal axis of said screw, said main flight
including a decreased pitch beginning substantially adjacent
to the terminal end of said barrier melting section and
resuming said decreased pitch through said reorientation
section wherein the main flight has a helix angle θ between
15° and 21°, said solids channel and said melt channel merge
into a substantially uniform reorientation channel at a
location substantially coinciding with said decreased pitch

of said main flight thereby forcing solid plastic material conveyed along said reorientation section toward said push side of the main flight; and

5 said main flight passing into said metering section, a secondary flight being disposed in said metering section intermediate said main flight whereby solid material conveyed along said metering section is positioned primarily adjacent said push side of the main flight and whereas melt material conveyed along said metering section is positioned primarily adjacent said trailing side of the main flight.

10 14. The apparatus of claim 13, wherein the helix angle θ of the main helical flight of the reorientation section and the melting section are substantially equal.

15 15. The apparatus of claim 14, wherein said barrier flight has a diameter substantially the same as said secondary flight.

20 16. The apparatus of claim 15, wherein said barrier flight has a width substantially the same as said secondary flight.